CLAIMS

We claim:

1. A light emitting device comprising:

a first semiconductor layer of a first conductivity type having a first surface;

an active region overlying the first semiconductor layer, the active region including a second semiconductor layer, the second semiconductor layer one of a quantum well layer and a barrier layer, the second semiconductor layer formed from a III-Nitride semiconductor alloy having a composition graded in a direction substantially perpendicular to the first surface of the first semiconductor layer; and

a third semiconductor layer of a second conductivity type overlying the active region.

2. The light emitting device of Claim 1, wherein the second semiconductor layer has a wurtzite crystal structure.

3. The light emitting device of Claim 1, wherein the composition of the III-Nitride semiconductor alloy is graded asymmetrically.

4. The light emitting device of Claim 1, wherein the composition of the III-Nitride semiconductor alloy is graded to reduce an effect of a piezoelectric field in the active region.

5. The light emitting device of Claim 1, wherein a mole fraction of the III-Nitride semiconductor alloy is graded linearly.

6. The light emitting device of Claim 1, wherein the III-Nitride semiconductor alloy is $In_xAl_yGa_{1-x-y}N$ with $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x + y \leq 1$.

7. The light emitting device of Claim 6, wherein the mole fraction of indium is graded.

8. The light emitting device of Claim 6, wherein the mole fraction of aluminum is graded.

9. A method of forming a light emitting device, the method comprising:

forming a first semiconductor layer of a first conductivity type and having a first surface;

forming an active region over the first semiconductor layer, the active region including a second semiconductor layer, the second semiconductor layer one of a quantum well layer and a barrier layer, the second semiconductor layer formed from a III-Nitride semiconductor alloy having a composition graded in a direction substantially perpendicular to the first surface of the substrate; and

forming a third semiconductor layer of a second conductivity type over the active region.

10. The method of Claim 9, further comprising forming the second semiconductor layer in a wurtzite crystal structure.

11. The method of Claim 9, further comprising grading the composition of the III-Nitride semiconductor alloy asymmetrically.

12. The method of Claim 9, further comprising grading the composition of the III-Nitride semiconductor alloy to reduce the effect of a piezoelectric field in the active region.

13. The method of Claim 9, further comprising grading a mole fraction of the III-Nitride semiconductor alloy linearly.

14. The method of Claim 9, wherein the III-Nitride semiconductor alloy is $In_xAl_yGa_{1-x-y}N$ with $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x + y \leq 1$.

15. The method of Claim 14, further comprising grading the mole fraction of indium.

16. The method of Claim 14, further comprising grading the mole fraction of aluminum.

17. The method of Claim 1, wherein the active region is formed directly on the first semiconductor layer.

18. A light emitting device comprising:

a first semiconductor layer of a first conductivity type having a first surface;

an active region overlying the first semiconductor layer, the active region including a plurality of quantum well layers and at least one barrier layer, the barrier layer formed from a III-Nitride semiconductor alloy having an indium mole fraction graded in a direction substantially perpendicular to the first surface of the first semiconductor layer; and

another semiconductor layer of a second conductivity type overlying the active region.

19. The light emitting device of Claim 18, wherein the barrier layer has a wurtzite crystal structure.

20. The light emitting device of Claim 18, wherein the indium mole fraction of the III-Nitride semiconductor alloy is graded asymmetrically.

21. The light emitting device of Claim 18, wherein the indium mole fraction of the III-Nitride semiconductor alloy is graded to reduce an effect of a piezoelectric field in the active region.

22. The light emitting device of Claim 18, wherein the indium mole fraction of the III-Nitride semiconductor alloy is graded linearly.

23. The light emitting device of Claim 18, wherein the III-Nitride semiconductor alloy is $In_xAl_yGa_{1-x-y}N$ with $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x + y \leq 1$.

24. The light emitting device of Claim 18, wherein the active region includes a plurality of barrier layers each formed from a III-Nitride semiconductor alloy having an indium mole fraction graded in a direction substantially perpendicular to the first surface of the first semiconductor layer.

25. A method of forming a light emitting device, the method comprising:

forming a first semiconductor layer of a first conductivity type having a first surface;

forming an active region overlying the first semiconductor layer, the active region including a plurality of quantum well layers and at least one barrier layer, the barrier layer formed from a III-Nitride semiconductor alloy having an indium mole fraction graded in a direction substantially perpendicular to the first surface of the first semiconductor layer; and

forming another semiconductor layer of a second conductivity type overlying the active region.

26. The method of Claim 25, further comprising forming the barrier layer in a wurtzite crystal structure.

27. The method of Claim 25, further comprising grading the indium mole fraction of the III-Nitride semiconductor alloy asymmetrically.

28. The method of Claim 25, further comprising grading the indium mole fraction of the III-Nitride semiconductor alloy to reduce an effect of a piezoelectric field in the active region.

29. The method of Claim 25, further comprising grading the indium mole fraction of the III-Nitride semiconductor alloy linearly.

30. The method of Claim 25, wherein the III-Nitride semiconductor alloy is $In_xAl_yGa_{1-x-y}N$ with $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $x + y \leq 1$.

31. The method of Claim 25, wherein the active region includes a plurality of barrier layers each formed from a III-Nitride semiconductor alloy having an indium mole fraction graded in a direction substantially perpendicular to the first surface of the first semiconductor layer.